

**Trace Element Uptake and Spatial Distribution in the Soil Nematode *Caenorhabditis elegans*.**

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Beamline(s): X26A

**Introduction:** Nematodes are an important member of the soil fauna. *Caenorhabditis elegans* are free-living bacteria-feeding nematodes. Recently a standardized method for the use of *C. elegans* as a test organism in soil toxicity testing has been adopted by the American Society for Testing and Materials (ASTM 2001). The relative short duration of the toxicity test coupled with the ease of recovery of *C. elegans* from the soil media suggest that this organism may be useful in bioaccumulation studies. To date, however, there have been few studies that have attempted to quantify whole body uptake of *C. elegans* exposed to trace elements or to study qualitative differences in trace element accumulation. In this study we report on the use of synchrotron-based X-ray fluorescence (S-XRF) to probe the spatial variability and localized concentration of Cu and Pb in *C. elegans* exposed to those metals in aqueous solution.

**Methods and Materials:** *C. elegans* were exposed to solutions of Cu and Pb at the EC<sub>50</sub> concentration for movement (30 mg L<sup>-1</sup> and 10 mg L<sup>-1</sup>, respectively) for 24 hrs. The organisms were then separated from the supernatant by centrifugation and repeatedly washed before being stored in formalin solution. Nematodes were mounted in agar gel on Kapton tape for presentation to the X-ray beam line. Mapping of Cu and Pb distribution and XRF spectra of Cu and Pb hot-spots were collected using a 0.010 mm focused monochromatic X ray beam at an energy set just above the Pb L $\beta$  binding energy. Nematodes were mapped in 2D using a 6 by 15 micron step size. Localized hot-spots of Cu and Pb were quantified by collecting XRF spectra for 5 minutes at these locations. Calibration of XRF response was performed using a agar gel spiked at concentration of 83  $\mu$ g g<sup>-1</sup> of Cu and Pb.

**Results:** A visual image and 2-D S-XRF for Cu- and Pb- expose nematodes are shown in Fig. 1 and 2 respectively. Clear qualitative distribution differences are readily apparent between Cu and Pb, with Cu uptake being relatively homogeneous throughout the nematode while Pb uptake was highly localized in the anterior. Quantitative XRF analysis of Cu and Pb hot-spots revealed that Cu concentrations were on the order of 80  $\mu$ g g<sup>-1</sup> while Pb concentrations exceeded 1000  $\mu$ g g<sup>-1</sup>.

**References:** Standard guide for conducting laboratory soil toxicity tests with the nematode *Caenorhabditis elegans*. 2001. American Society for Testing and Materials.

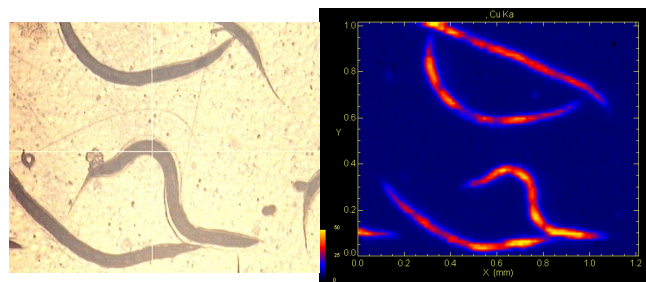


Figure 1: Visual and 2D-XRF of Cu-exposed nematodes

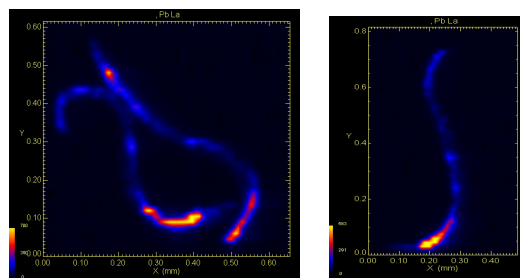


Figure 2A,B: 2D XRF map of Pb exposed nematodes.